**Remarks:**

Election of Claims

In response to the Restriction Requirement Applicant elects Invention I, claims 1-23, 28 and 54-55. Applicant reserves the right to pursue unelected claims in divisional applications.

Claim Rejections - 35 USC § 112

Claims 17, 24 and 27 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 17 has been corrected by amendment. Claims 24-27 have been canceled. Applicant respectfully submits that claim 17 now meets the requirements of 35 U.S.C. 112 and are now in condition for allowance.

Claim Rejections - 35 USC § 102

Claims 1-3, 5-6, 8-10 and 18 have been rejected under 35 U.S.C. 102(e) as being anticipated by Ohyama et al. (USPN 5,680,484). In view of the arguments and amendments herein Applicant respectfully submits that the rejections are traversed and that the claims are allowable over the reference.

Comparison of Ohyama with the Instant application

The instant application uses pseudo-projection methods that employ imaging optics to provide a pseudo-projection such that the depth of field is at least as large as the region of interest of the specimen. The method involves extending the depth of field by mechanically scanning the focal plane in a continuous manner, and integrating the images onto a detector during a single exposure. This method provides better spatial frequency response along the optical axis (better 3D MTF) compared with using long depth-of-field imaging optics because of the greater rejection of out-of-focus light by a high-NA objective.

Another advantage of the pseudo-projection method of the invention is that samples can be processed at higher speed ranging from at least 10 to 50 times faster than using the techniques of the prior art, including Ohyama et al. This is, at least in part, due to the fact that, since Ohyama acquires discrete cross-sections of the sample,

many cross-sectional images must be acquired in order to approximate the information in a single pseudo-projection image.

Thus, the generation of a pseudo-projection as taught by applicants is unique in optical tomography. The specification describes how to create a pseudo-projection with reference to FIG. 8A and FIG. 8B as follows.

> [0080] ...**for each period of relative motion of the objective, a pseudo-projection image of the specimen is scanned onto the detector array in a continuous scan over a single exposure.** Scanning is repeated for various views of the specimen as the micro-capillary tube is rotated. **The pseudo-projection image thus formed is an integration of the range of focal plane images** by the objective onto the detector array during each period of the scanning waveform R. (Specification Para 0080, emphasis added).

The advantage of this approach over the prior art is also pointed out in the specification as having greater speed. See, for example, Para [0008]:

> ...In this way, a set of pseudo-projections is generated, which can be input to a tomographic image reconstruction algorithm (such as filtered backprojection) to generate a three-dimensional image. The apparatus described has greater speed and higher signal-to-noise than the prior art ... while providing a means for 3D reconstruction by computer-aided tomographic techniques.

In contrast, Ohyama et al. and others, do not use pseudo-projection methods, but simply assemble discrete focal-plane scans into a 3D image with additional sampling errors from reconstructing from a set of projections. Furthermore, the spacing between each focal plane places a limit on the spatial resolution that can be achieved, and storage of the separate images requires large amounts of computer memory. In

addition, out-of-focus light from the other focal planes contributes to undesirable spurious signals (blurring) in the assembled image.

Detailed Analysis

Under § 102 the reference must teach each and every element of the claimed invention. In contrast to the instant application, Ohyama et al. teaches an optical image reconstructing apparatus including an optical image forming system ...forming a cross sectional image of an object in an object space onto an image formation surface in an image space, and focused surface control means for moving the optical image forming system along said optical axis of the optical image forming system to focus a **plurality of cross sectional images** of said object in said object space successively onto said image formation surface, while said object is at a given fixed rotational position (Ohyama, claim 1, lines 55-60, emphasis added).

Note that, in contrast to the instant application, there is no reference to integrating the plurality of cross sectional images on the image formation surface during a single integration cycle, i.e., a single exposure, of the image formation surface. In fact, a close reading of Ohyama shows that a succession of individual images are stored in memory 904. As stated by Ohyama, "images of an object, which have been picked up while moving the focused surface of the objective lens 720 over a range where the transparent tube 714 from the top to the bottom is completely included, are accumulated in the image processor 900 and stored in the image memory 904. ... The **individual images** [are] recorded in the memory 904." (Ohyama, Col. 8, lines 25 et seq.).

Ohyama's references to integration of the images refers to "linear-integrated projection image which has been employed in X-ray CT." (Ohyama, Col. 3, lines 30-34). Thus, Ohyama uses a successive series of projection images stored in memory and not, as the instant application teaches, "a pseudo-projection image of the specimen [scanned] onto a two-dimensional array of detectors **during a single exposure**" (Claim 1 as amended). Previously the term "single integration period" was used in claim 8 intended to have the same meaning as "during a single exposure." See the specification Abstract, for example, for reference to a single exposure.

Thus, the instant application has the advantage over Ohyama that a continuous series of focal planes is exposed during a single exposure of the two-dimensional array of detectors to produce a pseudo-projection that includes an integration of a range of focal plane images. Ohyama, on the other hand teaches away from the instant application in that Ohyama requires that **individual images** be recorded in memory while the lens is swept through the specimen. The instant application, therefore, provides a unique and different projection image that has proven extremely useful for optical tomography of microscopic objects.

Therefore, claim 1 as amended is patent over Ohyama and the other references whether taken singly or in any combination.

Claims 2-3, 5-6, 10 and 18 are, therefore, also allowable as depending from an allowable claim.

Claim Rejections - 35 USC § 103

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Palcic et al. (USPN 6,026,174). Applicant respectfully traverses the rejections based on the remarks and amendments herein. Under § 103 claim limitations cannot be ignored. Thus, the limitations of a base claim must be considered as part of a dependent claim.

Palcic et al. is cited for teaching automated feature extraction using a computer and algorithm based image analysis. However, Palcic et al. adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claim 4 is allowable over Palcic et al. and the other references, whether taken singly or in combination, as depending from allowable claim 1.

Claims 7, 12-13 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Krantz (USPN 6,248,988). Krantz is cited as teaching a confocal optical tomography system employing multiple sets of pseudo-projection viewing subsystems. However, Krantz adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claims 7, 12-13 and 15-16 are allowable over Krantz and the other

references, whether taken singly or in combination, as depending from allowable claim 1.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Cheng et al. (USPN 5,909,476). Cheng et al. (hereinafter Cheng) is cited for teaching simulations done with synthetic noise-free and noisy projection data based on several mathematical phantoms (col. 8, 11. 41-49). However, Cheng adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claim 11 is allowable over Cheng and the other references, whether taken singly or in combination, as depending from allowable claim 1.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Krantz (USPN 6,248,988) as applied to claim 13 above, and further in view of Short et al. (Pub. No.: 200310049841). Short et al. is cited for teaching capillary based screening for bioactivity (abstract). Short goes on, teaching using an arc lamp illumination source (0255). However, Short adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claim 14 is allowable over Short and the other references, whether taken singly or in combination, as depending from allowable claim 1.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Edgar (USPN 4,360,885). The optical imaging microscopy of Ohyama teaches all the limitations of the claimed invention except for expressly teaching moving an oil-immersion lens perpendicularly. Edgar is cited as teaching micro optical image tomography moving an oil-immersion lenses to acquire a continuum of focal planes (col. 3, 11. 20-22; col. 8, 11. 10-40). However, Edgar adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claim 17 is allowable over Edgar and the other references, whether taken singly or in combination, as depending from allowable claim 1.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Baer et al. (USPN 5,547,849). 37. Baer et al. (hereinafter Baer) is cited for teaching optical imaging for volumetric capillary

cytometery (abstract). However, Baer adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claim 18 is allowable over Baer and the other references, whether taken singly or in combination, as depending from allowable claim 1.

Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Tsujiuchi et al. (USPN 5,148,502). Tsujiuchi et al. (hereinafter Tsujiuchi) is cited for teaching an optical image apparatus for producing a plurality of images focused on different planes (abstract). Tsujiuchi is also is cited for teaching capturing images using an array of collimated fibers wherein each fiber is mapped to a single pixel on a photosensor array, where the array may be a CCD array. However, Tsujiuchi adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claims 19-20 are allowable over Tsujiuchi and the other references, whether taken singly or in combination, as depending from allowable claim 1.

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Rollins et al. (Pub. No.: 200310137669). Rollins et al. (hereinafter Rollins) is cited for teaching an optical tomography system comprising: an acousto-optic modulator, which is commonly known to comprise a transducer. Rollins is also cited for teaching using a microlens array positioned in front of a optical fiber so as to limit acceptance angle. However, Rollins adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claim 21 is allowable over Rollins and the other references, whether taken singly or in combination, as depending from allowable claim 1.

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Inaba et al. (Pub. No.: 200110040094). Inaba et al. (hereinafter Inaba) is cited for teaching capillary tube optical imaging (abstract). Inaba goes on, teaching injection to the inner lumen of the tube a liquid having a particular index of refraction (claim 5). However, Inaba adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image. Therefore, claim 23 is

allowable over Inaba and the other references, whether taken singly or in combination, as depending from allowable claim 1.

Claims 28 and 54-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohyama et al. (USPN 5,680,484) in view of Kardos et al. (USPN 6,312,914). Kardos et al. (hereinafter Kardos) is cited for teaching an apparatus for sensitive detection of analytes in microscopy (abstract) and for arranging at least two sets of illumination and image capturing systems in an arc about a specimen region to produce separate images of the specimen. Kardos goes on, teaching the use of dyes to label the specimen where the dyes show unique excitation bands. However, Kardos adds nothing to Ohyama to supply the missing limitation of producing a pseudo-projection image.

With respect to claim 28, as argued above analogously to claim 1, Ohyama is missing the claim step to compiling a pseudo-projection during a single exposure of the image capturing system. Therefore, claim 28 is allowable of Ohyama and all of the references whether taken singly or in any combination. By extension, claims 54 and 55 are allowable as depending from otherwise allowable claim 1.

New claim 56 is supported by the specification drawings 5A-6B and specification at Para [0039]:

> [0039] ... Still further, the motion system can be guided at submicron movements and can advantageously be applied in a manner that allows sampling of the cell at a resolution finer than that afforded by the pixel size of the detector. More particularly, the Nyquist sampling criterion could be achieved by moving the system in increments that fill half a pixel width, for example. Similarly, the motion system can compensate for the imperfect fill factor of the detector, such as may be the case if a charge-coupled device with interline-transfer architecture is used.

Applicants have made a diligent effort to place claims 1-4, 6-7, 10-23, 28 and 54-56 in condition for allowance. Reconsideration and further examination is respectfully requested. However, should there remain unresolved issues that require adverse

action, it is respectfully requested that the Examiner telephone George A. Leone, Applicants' Attorney at 253-682-0246 so that such issues may be resolved as expeditiously as possible.

For these reasons, and in view of the above amendments, this application is now considered to be in condition for allowance and such action is earnestly solicited.

Respectfully Submitted,

September 1, 2009
Date

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